IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Alex A. Behfar, et al.	)	Docket No. BIN 9/US
	)	
Application No. : 10/802,734	)	Group No.: 2828
	)	
Filed: March 18, 2004	)	Examiner: Golub, Marcia A.
	)	
For: High SMSR Unidirectional Etched Lasers and Low Back-Reflection Photonic Device	)	

DECLARATION UNDER 37 C.F.R. § 1.132 TO ESTABLISH NONOBVIOUSNESS BASED ON UNEXPECTED RESULTS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

1. I, Alex A. Behfar, PhD, am 46 years of age, am competent to testify and have personal knowledge of the facts stated herein.

2. I am one of the joint inventors of the invention (hereinafter referred to as "the subject invention") disclosed and claimed in the above-identified US patent application.

3. I hold Master of Science (M.S.) and Doctorate (Ph.D.) degrees in Electrical Engineering from Cornell University and a Bachelor of Science degree in Electrical and Electronic Engineering from King's College, University of London. I have been granted over 25 U.S. patents with additional patents pending. My experience in the areas of semiconductor photonic devices includes the following.

(a) During my M.S. and Ph.D. work at Cornell University, I demonstrated the first etched facet for a semiconductor laser that had a reflectivity equivalent to that of a cleaved facet semiconductor laser.

(b) I worked at IBM (more than 10 years) in various capacities, including Laser Enterprise, Microelectronics Packaging, CeramiCard and the Intellectual Assets group. I designed the epitaxial structure and physical layout of the first commercially viable high-power 980nm pump laser product. This technology was later sold by IBM to JDS Uniphase and is now part of Oclaro, Inc. I also served as IBM's worldwide cross-functional program manager for optoelectronics and telecommunications.

(c) My more recent work in etched facet photonic devices forms the basis of the company I cofounded; BinOptics Corp. BinOptics is in its tenth year of operation.

4. Based on my education and experience in the field of semiconductor photonic device design and development, and further based on my understanding of etched facet photonic devices, to a reasonable degree of certainty, state the following opinions and facts.

5. During research, which led to the subject invention, one goal was to develop a triangular ring laser or V-shaped laser in which either the right or left beam from the output facet of the laser would be more intense than the other. The motive for this work was that in many laser applications, only one intense beam of light is required and having two beams of equal or similar intensity was not desired for such applications since around half of the laser output would effectively be wasted. The decision was made to use my previously developed etching technology

to form a pair of gaps in one leg of the laser cavity in hopes that the gaps would break the symmetry in the laser cavity and result in either the right or left beam from the output facet of the laser being more intense than the other.

5. Numerous experiments were conducted in which two spaced gaps were etched in one leg of a two legged V-shaped epitaxial laser structure or in one leg of a three-legged triangular shaped epitaxial ring laser structure. The experiments confirmed that the gaps did in fact result in either the right or left beam from the output facet of the laser being more intense than the other, as shown in FIG. 4 of the subject application where the right beam has a higher intensity than the left beam.

6. The experiments also established that the gaps generated additional results that were completely unexpected. With the pair of gaps in the one leg, each laser cavity's side mode suppression ratio (SMSR) was greatly increased, for example, from a SMSR of about 13 dB for a laser without any gaps to approximately a SMSR of 38 dB for a laser with the two gaps, as shown in the graph of FIG. 3 of the subject application. Since the decibel (dB) is a well-known logarithmic unit of measurement, the increase from 13 dB to 38 dB represents over a 300 fold improvement in the SMSR. This result enhances the performance of the laser substantially by increasing the spectral purity of the resulting output laser beam and thereby facilitating transmission of the beam along longer lengths of fiber-optics, for example. Before these experiments, even with my extensive experience in the field, I would not have expected that the two gaps would affect the SMSR of the lasers in this beneficial manner.

7. I hereby further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that will false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: May 7, 2010

Signed: /Alex A. Behfar/
Alex A. Behfar